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SMD Operations Procedures Manual

8.1.1.6 OPERATION OF CORRECTOR COIL WIRING MACHINE

Text Pages 1 through 23
Attachments 1, 2, 3, 4, 5

Hand Processed Changes

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8.1.1.6 Operation of Corrector Coil Wiring Machine

1.0 Purpose and Scope

1.1 This procedure provides instruction in the operation of the Corrector Coil Wiring Machine, located at Assembly Station 5 in Building 197.

1.2 This procedure establishes the minimum qualification for any person who will operate the Wiring Machine.

2.0 Responsibilities

2.1 Authorized operators of the Wiring Machine will perform the tasks described here. A list of authorized operators is maintained by the Cognizant Technical Supervisor in Building 197.

2.2 The operator shall complete the following documentation:

2.2.1 Log Book. Entries shall include: 1) Machine settings; 2) notes of any irregularities regarding operation of the Machine.

2.2.2 Interlock Test Form. The form shall be completed when the safety interlocks are tested. A copy of the form shall be posted near the Wiring Machine.

3.0 Prerequisites

3.1 Training

3.1.1 Operator shall be hands-on trained by the Cognizant Technical Supervisor before operating the Wiring Machine.

3.1.2 Operator shall be trained as an "affected employee" as defined by SEAPPM 1.5.1, II. B., "Lockout/Tagout Requirements".

3.2 Initial State of Wiring Machine

3.2.1 Operator controls shall be set to their "initial" settings (see paragraph 5.3) before activating power to the Wiring Machine.

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4.0 Precautions

This procedure involves working near moving machinery.

4.1 Do not wear loose clothing or hanging jewelry. Keep long hair tied up.

4.2 All guards and covers should be in place.

4.3 Keep hands away from the wiring head when the Machine is in motion. A sudden movement might hit your hand or catch your clothing, causing injury.

4.4 A test of the interlocks shall have been performed within the last six months. A dated Interlock Test Form should be posted near the Wiring Machine.

5.0 Procedure

5.1 Overview

The Corrector Coil Wiring Machine at Assembly Station 5 provides a means of feeding wire in a tightly controlled pattern onto a flat substrate while bonding the wire to the substrate.

The Machine consists of an X-Y servo driven table, a wiring head capable of rotating and lifting off of the table, an ultrasonic system to bond the wire, and a wire feed.

The Machine is computer controlled, with a keyboard for operator input and a monitor for display of menu-driven operating instructions and Machine status. A joystick hand control is also provided to allow manual control of table movement and wiring head rotation during alignment, set up, and maintenance.

5.2 Operator Controls

5.2.1 System Controls (Attachment 1)

A. Item 1 - 120 VOLTS Input Disconnect Switch. Disconnects all power to the Machine.

B. Item 2 - CRASH red mushroom-head push buttons (qty 4). De-activates power to the servos; causes all machine motion to stop; requires that the Machine be RESET before power can be re-activated.

C. Item 3 - RESET green lighted push button. Resets Machine upon power up, or after an emergency shut-down.

D. Item 4 - ON green push button. Activates power to the servos after the RESET button is depressed.

E. Item 5 - OFF black push button. De-activates power to the servos; the Machine does not have to be RESET before re-activating power to the servos.

F. Item 6 - CONTROL POWER ON red indicator light. Illuminates when power to the servos is activated.

G. Item 7 - Joystick control. Controls table motion and head rotation when enabled by the computer controller. Three push buttons on joystick box are not functional.

H. Item 15 - Wire Feed Motor Speed Control. Potentiometer with readout located on the back panel of the computer. Controls speed of wire feed during run. Normally will not need readjustment once set.

5.2.2 Air Flow and Pressure Controls (Attachment 1)

A. Item 8 - Main air feed shut-off valve.

B. Item 9 - SLIDE LO regulator and gauge. Regulates air pressure to the wiring head lift cylinder.

C. Item 10 - SLIDE HI regulator and gauge. Regulates air pressure to the wiring head lift cylinder.

D. Item 11 - AIR regulator, gauge, and two-position toggle switch. Regulates cooling air to the stylus; toggle switch turns air flow on or off.

E. Item 12 - LO PRESSURE regulator and gauge. Regulates air pressure to the stylus while wire is being bonded to the substrate.

F. Item 13 - HI PRESSURE regulator and gauge. Regulates air pressure to the stylus while wire is being "tacked" to the substrate (at corners).

G. Item 14 - GAUGE regulator and gauge. Regulates air pressure to the stylus during "short lifting" of the stylus.

5.2.3 Ultrasonic Controls

Ultrasonic Generator (Kollmorgen, Electronic Equipment Division, model T14A0018) (Attachment 2)

A. Item 1 - ON/OFF toggle switch. Activates power to the U/S Generator.

B. Item 2 - NULL/NORM toggle switch. Calibration use; set to the NORM position during operation.

C. Item 3 - Three-position selector switch (labeled "1", "2", "3"). Calibration use; set to the "2" position during operation.

D. Item 4 - DC mA meter. Indicates the power output of the Generator. Operator aid only. The actual values indicated are not meaningful.

E. Items 5 through 10 - Tuning adjustments. Calibration use; not used during operation.

Ultrasonic Generator Power Supply (Attachment 2)

A. Item 14 - Test jacks. Allows the output of the power supply to be monitored by connecting a voltmeter to the test jacks. The voltage across the jacks is 4.7 volts per 1 amps output.

B. Item 15 - CURRENT ADJUST Potentiometer. Adjusts current output of the Supply; calibration use; not used during operation.

Wattmeter (BNL) (Attachment 3)

A. Item 1 - ON/OFF toggle switch. Activates power to the Wattmeter.

B. Item 2 - Indicator lights (3). Illuminate when power is activated.

C. Item 3 - Potentiometer with readout. Not functional when MAN/SWEEP/NULL selector switch (Item 4) is set to NULL (as it is during operation).

D. Item 4 - MAN/SWEEP/NULL three position selector switch. Calibration use; set to NULL during operation.

E. Item 5 - SINE WAVE/SQUARE WAVE toggle switch. Selects the control output waveform sent to the U/S Generator. Calibration use; set to SINE WAVE during operation.

F. Item 6 - Potentiometer. Adjusts the output amplitude; calibration use; set to the OFF position during operation.

G. Item 7 - IDLE/RUN/NULL three-position toggle switch. Calibration use; set to the RUN position during operation.

H. Item 8 - WATT/AMP/VOLT selector switch. In the WATT position, the digital display (Item 9) indicates the power (in watts) dissipated by the ultrasonic stylus; in the AMP position, the display indicates the DC bias current (in amps) on the stylus; in the volt position, the display indicates the voltage drop (in volts) across the coil of the stylus.

J. Item 9 - Digital display. Displays the parameter selected by the WATT/AMP/VOLT selector switch (Item 8).

K. Item 10 - TEST push button. Depressing the TEST push button causes the maximum power output of the U/S Generator to be applied to the stylus; calibration use; do not depress during operation.

L. Item 11-- TEST POINTS. Calibration use.

5.3 Initial Control Settings

Ultrasonic Generator (Attachment 2)

5.3.1 ON/OFF toggle switch (Item 1) set to OFF.

5.3.2 Selector switch (Item 3) set to position #2.

Wattmeter (Attachment 3)

5.3.3 MAN/SWEEP/NULL three position selector switch (Item 4) set to NULL.

5.3.4 SINE WAVE/SQUARE WAVE toggle switch (Item 5) set to SINE WAVE.

5.3.5 Potentiometer (Item 6) set to OFF.

5.3.6 IDLE/RUN/NULL three-position toggle switch (Item 7) set to RUN.

5.3.7 WATT/AMP/VOLT selector switch (Item 8) set to WATT.

5.3.8 ON/OFF toggle switch (Item 1) set to OFF.

5.4 Starting Up the Wiring Machine

5.4.1 Refer to the applicable Magnet Assembly Procedure for instructions on setting up the substrate on the table.

5.4.2 Verify that the controls are set to their "initial" settings (5.3).

5.4.3 Turn on the air supply by turning the valve on the air line next to the Machine. Verify that the regulator settings are as per the log book for the Machine.

5.4.4 Mount the wire spool and thread the wire through the wiring head.

5.4.5 Place the 120 VOLTS disconnect switch, located on the Machine, in the ON position.

5.4.6 Turn on the computer by operating the rocker switch on the computer case. Wait until the Main Menu of the control software is displayed on the monitor.

5.4.7 Depress the RESET green lighted push button.

5.4.8 Depress the ON green push button on the Control Box. Verify that the CONTROL POWER ON red indicator light illuminates.

5.4.9 Activate power to the Ultrasonic Generator by placing the ON/OFF toggle switch in the ON position.

NOTE ***Allow the Generator to warm up for ten minutes before using it.***

5.4.10 Activate power to the Ultrasonic Wattmeter by placing the ON/OFF toggle switch in the ON position.

5.4.11 Choose an action from the menu of action choices on the computer monitor. Type your choice on the keyboard. (Refer to the next section for a description of the operator choices available from the software menu).

5.5 Computer Software Menu System (refer to Attachment 4):

NOTE ***1. If the menu choice has a default value, a carriage return will execute the default.***

2. Submenus and additional prompts to a menu choice are indicated in this section by sub-paragraphs. For instance, the choice in paragraph 5.5.1 leads to additional choices which are described in paragraph 5.5.1.1.

3. Quotations indicate exactly what appears on the screen.

5.5.1 Main Menu (Attachment 4, Fig. 1) choice "F...Open Wire File. (Xoffset=0.000 Yoffset= 0.060"

This is generally the first choice that the operator will make. Each coil type has its own run file. The default offsets are displayed. They may be changed in the "Diagnostics" section.

5.5.1.1"File To Open>"

Type the name of the file for the particular coil type.

5.5.2 Main Menu, choice "H...Home all three axis"

This choice will cause the table and the head to move to the "home" position. The Main Menu will display the message: "Axes Have Been Homed."

5.5.3 Main Menu, choice "G...Gage the Head"

5.5.3.1"X axis Gage position (5.000)>"

"Y axis Gage position (-0.100)>"

"Theta axis Gage position (0.000)>"

"Move to Gage position? Y/N (Y)>"

If desired, change the default axis positions. When the proper positions have been entered, press "Y" to move the head to the Gage position.

5.5.4 Main Menu, choice "R...Enter RUN mode"

5.5.4.1"Sequence Number: (Carriage return for beginning)>"

If the run will start at some point in the middle (as it would, for instance, for an interrupted run), type in the proper sequence number to tell the program where to begin.

If the run will start at the beginning (as it would, for instance, for a new coil), press the carriage return.

5.5.4.1.1 "Stop at every point? Y/N (Y)?>"

Type "Y" to stop the run at the end of every sequence.
Type "N" to allow the run to continue to the end.

The run will now commence.

5.5.4.2 The next screen to appear contains Machine status information. (Attachment 4, Fig. 2).

Wire is fed through the head automatically. The computer displays the message: "Feed Out Wire".

5.5.4.3 "Press Carriage Return when finished and the head will be lowered>".

Press the carriage return to lower the head to the substrate.

5.5.4.4 "Press Carriage Return when ready to tack>"

Press carriage return to tack the wire to the substrate.

5.5.4.5 "Start Run (Y or N)>"

Type "Y" to commence the run.

5.5.4.6 "Press [F1] key to Pause while in Motion"

This choice is displayed during the run. Pressing [F1] causes the run to pause but does not abort the run, so that it may be resumed easily. A sub-menu of choices appears (Attachment 4, Fig. 3).

5.5.4.6.1 "Press [F2] key to Continue from Point of Pause."

Resumes the run.

CAUTION

Raising and lowering the head requires manual feed of wire. Failure to observe this caution may result in damage of the feeder or coil.

5.5.4.6.2 "Press [F3] key to Raise the Head."

Raises the wiring head.

5.5.4.6.3 "Press [F4] key to Lower the Head."

Lowers the wiring head.

5.5.4.6.4 "Press [F5] key to Return to Main Menu."

Returns the operator to the Main Menu.

5.5.5 Main Menu, choice "D...Enter Diagnostics Mode"

The Diagnostics section allows manual control of Machine functions.

Machine status information and operator choices are displayed (Attachment 4, Fig. 4).

5.5.5.1 "G...Go to X, Y, Theta position."

Prompts for the desired X, Y, and Theta positions. Moves the head to that position.

5.5.5.2 "D...Down Head toggle."

Raises and lowers Head.

5.5.5.3 “S...Short Lift toggle."

Causes the stylus to be lowered to the wiring position. This is done before head gaging.

5.5.5.4 "F...Feed Motor toggle."

Turns the wire feed motor on or off.

5.5.5.5 "U...Ultrasonics toggle."

Turns the Ultrasonic Generator output on or off.

5.5.5.6 "H...High Pressure toggle."

Causes the stylus to press hard into the substrate momentarily, as is done during "tacking" of the wire.

5.5.5.7 "L...Low Pressure toggle."

Causes the stylus to press softly into the substrate, as is done during the wire bonding process along straight runs (when "tacking" is not needed).

5.5.5.8 "O...Change X/Y offsets."

Prompts for the desired X and Y axis offsets. Applies an offset to every coordinate in the files.

5.5.5.9 "J...Joy Stick Control."

Activates joystick control of both direction and speed of table motion or head rotation (Attachment 4, Fig. 5).

5.5.5.9.1 "B...Assign Joystick to (B)oth X & Y Velocities."

Selects joystick control of direction and speed of table motion along the X and Y axes.

5.5.5.9.2 "T...Assign Joystick to (T)heta Velocity."

Selects joystick control of direction and speed of head rotation.

5.5.5.9.3 "O...Toggle X & Y (O)ptical Limit Stop."

Defeats and restores the optical table motion limit switches.

5.5.5.9.4 "E...(E)xit to Diagnostic Menu."

Exits back to the Diagnostic Menu.

5.5.5.10 "E...Exit to Main Menu."

Exits the Diagnostics Menu and displays the Main Menu.

5.5.6 Main Menu, choice "E...Exit program"

Exits the program.

5.6 Shutting Down the Wiring Machine

5.6.1 Remove the coil from the table.

5.6.2 Depress the OFF black push button on the control box to de-activate servo power.

5.6.3 Exit from the control software.

5.6.4 Turn off the computer.

5.6.5 Place the 120 VOLTS disconnect switch in the OFF position.

5.6.6 Turn off air.

5.7 Testing the Safety Interlocks

NOTE ***The test procedure shall be performed at a six month interval.***

5.7.1 Set all controls to their initial settings (5.3)

5.7.2 Place the 120 VOLTS disconnect switch, located on the Machine, in the ON position.

5.7.3 Turn on the computer. Wait until the Main Menu of the control software is displayed on the monitor.

5.7.4 Depress the RESET green lighted push button.

5.7.5 Depress the ON green push button on the control box. Verify that the CONTROL POWER ON red indicator light illuminates.

5.7.6 Set the Machine to operate under joystick control. To do this, select "D...Enter Diagnostics mode" from the Main Menu. Select "J...Joy Stick Control" from the Diagnostics Menu. Select "B..Assign Joystick to (B)oth X & Y Velocities" in the Joystick Menu.

5.7.7 Operate the joystick. The table should move accordingly.

5.7.8 Depress a CRASH mushroom push button. The table should stop moving and the servos should shut off. The CONTROL POWER ON red

indicator light and the RESET green lighted push button should extinguish.

5.7.9 Check the appropriate box on the Interlock Test Form (Attachment 5).

5.7.10 Test all four CRASH push buttons. To re-start the Machine after each crash, depress the RESET green lighted push button and the ON green push button.

5.7.11 After the last CRASH push button has been tested, re-start the Machine by depressing the RESET push button and the ON push button.

5.7.12 Using the joystick, move the table toward one of its limits.

5.7.13 Before the end of the track is reached, an optical limit switch should trip. Motion should stop. The servos remain on.

5.7.14 On the keyboard, type "O" to disable, or bypass, the optical switch.

5.7.15 Continue moving the table in the same direction.

5.7.16 Before the end of the track is reached, a mechanical limit switch should trip. Motion should stop and the servos should shut off.

5.7.17 To re-start the Machine, operate the joystick once in the opposite direction (this places a code in the computer memory; the table will not move yet).

5.7.18 Depress the RESET green lighted push button and ON green push button simultaneously.

5.7.19 Operate the joystick to move the table away from the end of the track.

5.7.20 Type "O" to re-enable the optical limit switch.

5.7.21 Check the appropriate boxes on the Interlock Test Form.

5.7.22 Repeat Steps 5.7.12 through 5.7.21 for the remaining three limits.

5.7.23 Initial and date the Form and post it near the Wiring Machine.

5.7.24 If an interlock fails, stop work, write "fail" on the Form, and immediately notify the Cognizant Engineer and the ES&H Coordinator.

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5.8 Aligning the Stylus and the Lower Wire Guide

WARNING

The ultrasonic generator must be turned off during the procedure. Otherwise, a burn can result from touching the stylus.

5.8.1 Verify that the controls are set to their "initial" settings (5.3).

5.8.2 Mount the wire spool (do not thread the wire through the wiring guide yet).

5.8.3 Place the 120 VOLTS disconnect switch, located on the Machine, in the ON position.

5.8.4 Turn on the computer by operating the rocker switch on the computer case. Wait until the Main Menu of the control software is displayed on the monitor.

5.8.5 Depress the RESET green lighted pushbutton.

5.8.6 Depress the ON green pushbutton on the Control Box. Verify that the CONTROL POWER ON red indicator light illuminates.

5.8.7 Home the wiring head using choice "H" of the Main Menu.

5.8.8 Set the Machine to operate under joystick control as follows:

5.8.8.1 Choose "Diagnostics" (choice "D") from the Main Menu.

5.8.8.2 Choose "Joystick Control" (choice "J").

5.8.8.3 Choose "B" for control of X, Y movement or "T" for control of head rotation (Theta direction). Both choices will be required at different times during the rest of the procedure.

5.8.9 Clamp the alignment scope to the corner of the table.

5.8.10 Using the joystick, move the table so that the stylus tip is visible in the scope view. Center the stylus inside the small circle of the scope using the thumbscrew adjustment on the scope.

5.8.11 Align the parallel lines of the scope with the line at the bottom of the wire guide by rotating the eyepiece.

5.8.12 Loosen the locking screw holding the stylus and turn the stylus so that the lips of the stylus are aligned with the parallel lines in the scope.

5.8.13 Lower the stylus just below the hole in the wire guide. Lock the stylus.

5.8.14 Double check that the lips of the stylus are aligned with the parallel lines of the scope.

5.8.15 Loosen the two 8-32 screws on top of the head. Loosen the four 2-56 locking nuts on the side of the head (two of the 2-56 screws adjust the wire feeder; two of the screws adjust the stylus; a fifth 2-56 screw is a jacking screw that adjusts the tilt of the stylus).

5.8.16 With the three 2-56 stylus adjustment screws, adjust the stylus so that it is centered in the scope when the head is turned 360°.

5.8.17 If the stylus is perfectly centered, lock the two 8-32 screws on top of the head and lock two nuts on both sides of the head.

5.8.18 Recheck stylus alignment for center rotation by rotating the head 360°.

5.8.19 Loosen 1 10-32 screw holding the feeder. Move the feeder away from the stylus 1/8 inch and lock it.

5.8.20 With the adjusting screw on the scope, move the scope until the wire guide and stylus are visible and aligned with the parallel lines.

5.8.21 Loosen two 6-32 screws holding the feeder.

5.8.22 Feed out a short piece of wire through the wire guide. Align the wire guide using two 2-56 screw on both sides of the feeder so that the wire runs exactly between the stylus lips.

5.8.23 Lock the two 6-32 screws holding the feeder and recheck alignment. If alignment has been maintained, lock the two 2-56 nuts.

5.9 Setting Up and Calibrating the Ultrasonic (U/S) Unit

NOTE ***The Ultrasonic Unit is calibrated on an "as needed" basis. The Unit should be calibrated when any of the following occur: 1) the wire is not bonding properly to the substrate; 2) the wattmeter is indicating a large drop in power being delivered to the stylus; 3) the stylus is replaced.***

5.9.1 Equipment Needed to Tune U/S Unit

A. U/S Wattmeter Tuning Module (T14A0071)

B. Plastic calibration screwdriver

C. Oscilloscope with differential input (minimum bandwidth 100 KHz) with 10X probe.

CAUTION

The oscilloscope input must be isolated from the oscilloscope case and from the power ground. Failure to do this will cause equipment damage.

5.9.2 Initial Equipment Hook-up and Settings

5.9.2.1 Set AC ON/OFF switch on U/S Generator to "OFF" (Attachment 2, Item 1).

5.9.2.2 Unscrew and disconnect the two pronged plug for wires leading to the U/S coil in wiring head. Connect this plug to the front of U/S Wattmeter in socket marked "U/S COIL" (Attachment 3, Item 12).

5.9.2.3 Connect the plug on the cable exiting from the rear of the U/S Wattmeter, marked "TO U/S OUTPUT" (Attachment 3, Item 13), to the mating socket on the U/S Generator.

NOTE ***Make certain that the connections done in steps 5.9.2.2 and 5.9.2.3 are well seated and secure. Never run U/S Generator without load.***

5.9.2.4 Connect the plug on the cable exiting from the rear of the U/S Wattmeter, marked "TO U/S TEST PLUG" (Attachment 3, Item 14), to the mating socket on the U/S Generator.

5.9.2.5 Connect the power cord from the U/S Wattmeter, and the power cord from the Power Supply, to switched 115V service outlets on the Multiwire Machine.

5.9.2.6 Connect the cable from the back of the U/S Generator to the jack in back of the Power Supply.

5.9.2.7 Set the AC power switch on the U/S Wattmeter to "ON" and wait for 10 minutes (Attachment 3, Item 1).

5.9.2.8 Connect oscilloscope probe to test point H and test point K (ground) on U/S Wattmeter. (This is to test output of U/S Wattmeter)

5.9.2.9 Set oscilloscope vertical gain to 20mv/div (AC) and sweep rate to 10uS/div.

5.9.2.10 Place U/S Wattmeter switch marked with a sine wave figure and a square wave figure (Attachment 3, Item 5) towards the sine wave figure.

5.9.2.11 Place U/S Wattmeter switch marked IDLE-RUN-NULL (Attachment 3, Item 7) on position NULL.

5.9.2.12 Place U/S Wattmeter switch marked MAN-SWEEP-NULL (Attachment 3, Item 4) on position NULL.

5.9.2.13 Turn amplitude control on U/S Wattmeter (Attachment 3, Item 6) until a signal of 23KHz and about 100mv p-p is observed on the oscilloscope screen.

NOTE ***To measure a frequency F on an oscilloscope: F=1/T where T is the time for one cycle.***

T = 43.5 uS for F=23000 Hz.
T = 40 uS for F=25000 Hz.

CAUTION

Failure to set "null/norm" switch to "null" before proceeding could cause the stylus to be subjected to a large amplitude signal, damaging the stylus.

5.9.2.14 On U/S Generator, place "NULL/NORM" switch on "NULL" position (Attachment 2, Item 2).

5.9.2.15 Turn U/S Generator rotary switch to position 2 (Attachment 2, Item 3).

5.9.3 To Adjust Stylus DC Bias Current

NOTE ***The DC-bias current should be adjusted to 1.1A ± 0.1A.***

This adjustment is done on the power supply for the U/S Generator. The stylus bias current is a direct current flowing through the U/S coil in the wiring head. The current's function is to magnetically polarize the stack on the stylus.

Its adjustment is very critical. The amount of energy transferred to the stylus is greatly affected by the DC-bias current. Wrong setting will cause poor bonding or reduce stylus life.

5.9.3.1 Set the AC power switch to "ON" on the U/S Generator (Attachment 2, Item 1).

5.9.3.2 Place switch marked WATT-AMP-VOLT on U/S Wattmeter (Attachment 3, Item 8) on AMP position.

5.9.3.3 With a small screwdriver, adjust the potentionmeter on the Power Supply labeled CURRENT ADJUST (Attachment 2, Item 15) until the current is 1.1A ± 0.1A. (This value is read on the digital display on the U/S Wattmeter.)

5.9.4 Bridge Calibration

5.9.4.1 Connect oscilloscope probe to test point "F" and test point "K" (ground) on the Wattmeter.

5.9.4.2 Adjust Coil "E" on the Generator (Attachment 2, Item 9) for minimum signal as displayed on oscilloscope. Always tune Coil "E" through a minimum, until signal increases, then back off again to minimum. This is to ensure that a true minimum is found.

NOTE ***On some units Coil E has to be turned all the way out to approach minimum; therefore, adjusting it through a minimum is not possible. These units may not be stable.***

If a big enough signal cannot be obtained on the oscilloscope for adjusting Coil E, turn potentiometer B in the CW direction to get a larger, more visible signal to tune with.

Failure to tune Coil E correctly may cause the U/S generator to operate intermittently, and to drift out of tune.

5.9.4.3 Adjust pot. B (Attachment 2, Item 7) to a minimum signal as displayed on the screen.

5.9.4.4 Adjust pot. E again to verify that a minimum has been achieved.

5.9.4.5 Turn the amplitude control on the U/S Wattmeter (Attachment 3, Item 6) to "OFF", but leave test jack plugged in the U/S generator.

5.9.5 Initial Gain Loop Adjustment

CAUTION

Failure to follow these steps exactly could cause damage to the stylus.

5.9.5.1 Connect oscilloscope probe to test point "B" and the ground lead to test point "K" on the Wattmeter.

5.9.5.2 Set oscilloscope vertical gain to 10V/div. and sweep rate to 10uS/div. Set the input for AC only.

5.9.5.3 Set U/S Generator rotary switch to position 2 (Attachment 2, Item 3).

5.9.5.4 Place "NULL/NORM" switch on Generator on "NORM" (Attachment 2, Item 2). A sine wave (5 to 20 volt p-p) may occur.

NOTE ***If there is no signal present, or it is very weak, potentiometer C may have been turned too far in CW direction. If no signal can be obtained, see note under next paragraph.***

5.9.5.5 Place switch marked WATT-AMP-VOLT on U/S Wattmeter (Attachment 3, Item 8) on position WATT.

5.9.5.6 While watching oscilloscope screen press the pushbutton marked TEST on the U/S Wattmeter (Attachment 3, Item 10). A sine wave of no more than 45V p-p should be present on screen and digital display on U/S Wattmeter should read no more than maximum 25 watts. If a larger amplitude or wattage is appearing, release pushbutton immediately and adjust pot. D (Attachment 2, Item 5) in CW direction. If an increase in amplitude is needed, turn pot. D in CCW direction.

NOTE ***If no signal is present, pot. D may have been turned too far CW. If turning pot. D in CCW direction does not help, try to tune coil G. This will very often bring the oscillations back! Do not exceed 45V p-p or 25 watts.***

5.9.5.7 Adjust "run" amplitude to 45V p-p or 25 watts (maximum allowed) by turning pot. D CCW.

NOTE ***Turning the rotary switch on U/S Generator to pos. 3 will also give max. swing. However, leaving the unit with full swing for more than 15 sec. may damage the stylus. Using the TEST pushbutton was found to be a safer procedure.***

5.9.6 Idle Voltage Adjustment

5.9.6.1 Set U/S Generator rotary switch (Attachment 2, Item 3) to position 2.

5.9.6.2 Adjust U/S Generator pot. C until "idle voltage" is 8 to 12V p-p.

5.9.6.3 Gently press a scrap piece of substrate material against the stylus and depress the TEST pushbutton. Verify that the adhesive on the substrate melts. If it does not, re-adjust pot. C and try again.

5.9.7 Loop Tuning

5.9.7.1 Depress TEST pushbutton on U/S Wattmeter (Attachment 3, Item 10).

5.9.7.2 Check that the signal (the "run voltage") on the oscilloscope is from 40V p-p to 45V p-p. If the signal is too large, adjust pot. D.

5.9.7.3 Check that the signal has a frequency of 25000 Hz. Tune coil G (Attachment 2, Item 10) until this frequency is obtained.

5.9.7.4 Adjust Coil "G" to tune signal. When the loop is correctly tuned, the waveform will "snap" to the proper frequency, and a "knee" will be apparent on the left side of the positive part of the wave form. (This "snapping" action is most apparent when tuning from a lower frequency to a higher).

NOTE ***If the "knee," or indentation, does not occur, it may be an indication of a questionable stylus.***

5.9.8 Final Tuning

5.9.8.1 Verify that the oscilloscope is connected to points K (ground) and B (signal).

5.9.8.2 Set the rotary switch on U/S generator to position 2

5.9.8.3 Check that the switch marked WATT-AMP-VOLT (Attachment 3, Item 8) on U/S Wattmeter is in position WATT.

5.9.8.4 Carefully adjust coil G while observing the digital display on U/S Wattmeter. Coil G should be adjusted through a maximum, or peak wattage, and then back to maximum. Coil G will now be

correctly tuned for maximum efficiency. While tuning Coil G, care must be taken not to exceed the maximum values of 25 Watts or 45V p-p. (Best settings are: 40V p-p, 23W, 1.1A)

5.9.8.5 If optimum readings cannot be obtained, repeat the tuning procedures beginning from step 5.9.4.

5.9.8.6 Make final adjustment of power output by adjusting pot. D for consistently good wire bonding while wiring. Do not exceed 45 Watts output.

6.0 Documentation

6.1 Log Book

6.2 Interlock Test Form

7.0 References

7.1 SEAPPM 1.5.1, II. B., "Lockout/Tagout Requirements".

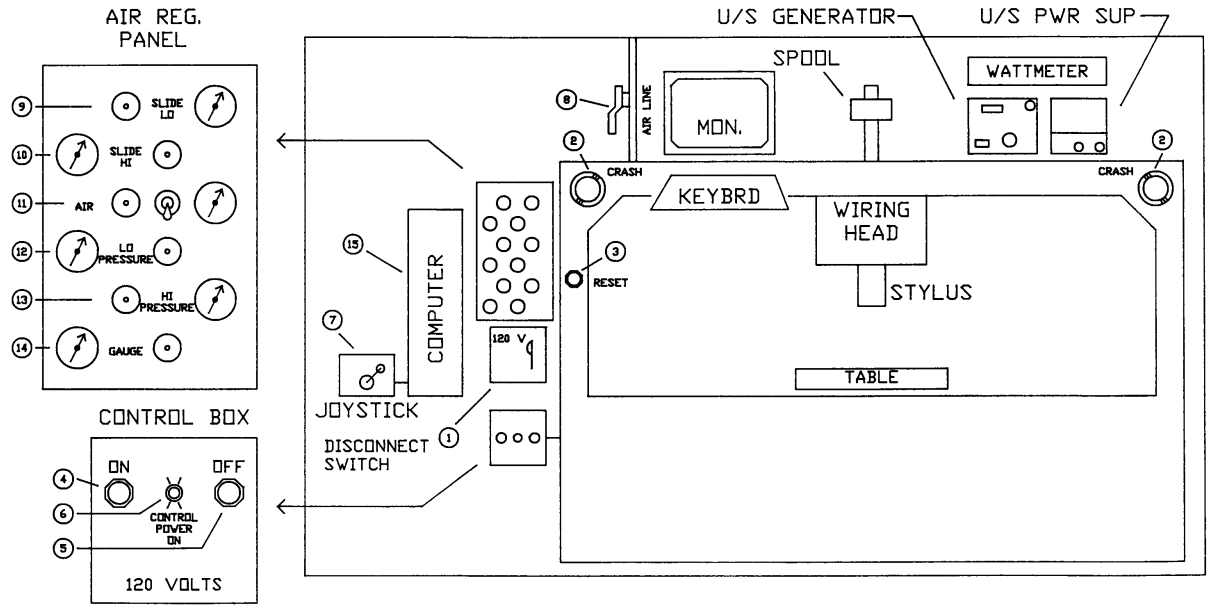
8.0 Attachments

1. Wiring Machine Diagram.
2. Ultrasonic Generator and Power Supply.
3. Wattmeter.
4. Computer Menu System.
5. Interlock Test Form.

The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that this is the most current version by checking the document issue date on the website.

Attachment 1

Wiring Machine Diagram



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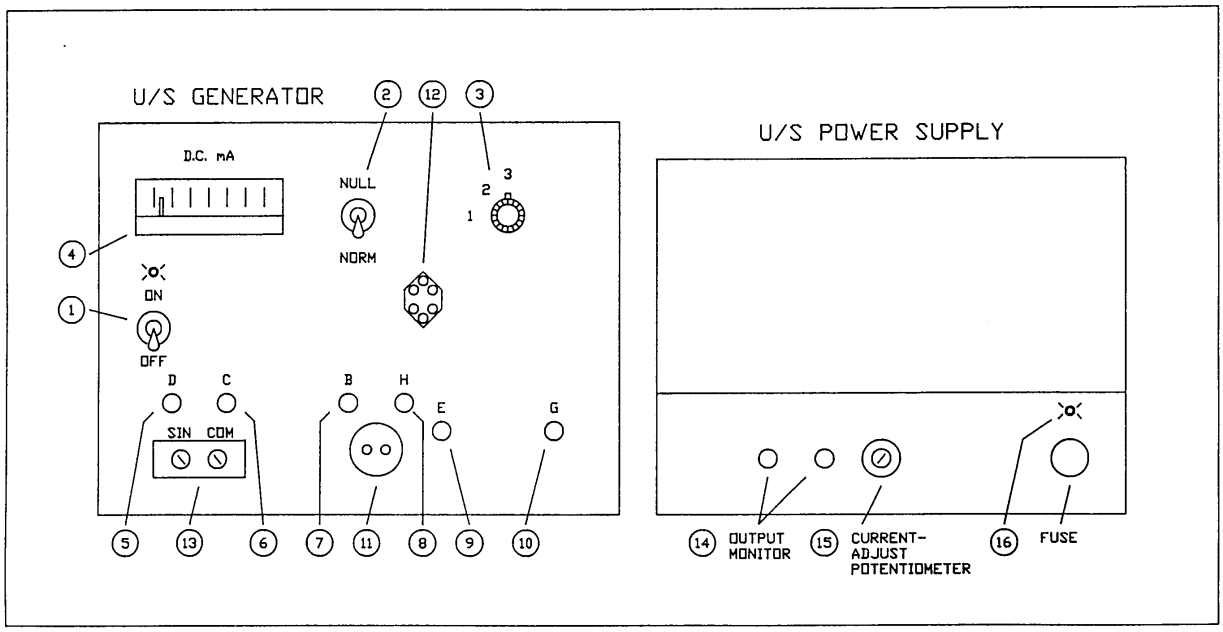
Attachment 2

Ultrasonic Generator and Power Supply



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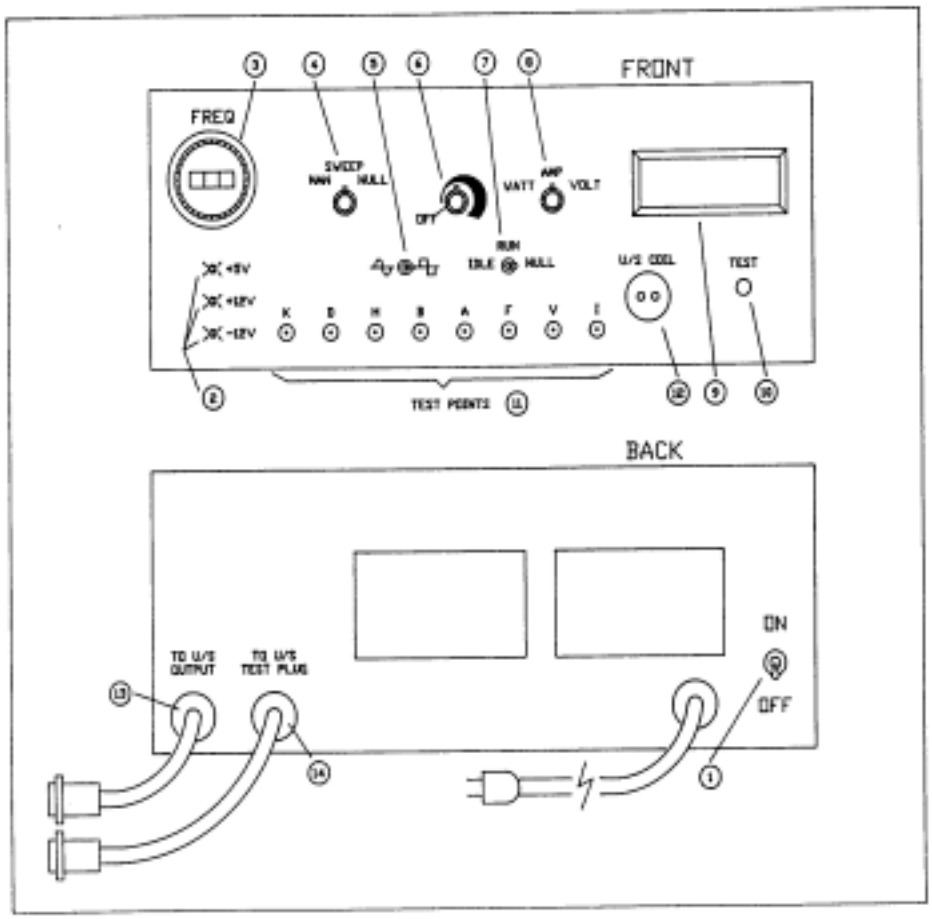
Attachment 3

Wattmeter



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Attachment 4

Computer Menu System

```
     BNL Corrector Magnet Machine Controller (CMMC) Program  v1.0

         **************CMMC PROGRAM MAIN MENU*************

       Wire File Open : (rdc1c.dat)

       Axes Have Been Homed.

          F.......Open Wire File. (Xoffset= 0.000 Yoffset= 0.060)
          H.......Home all three axis.
          G.......Gage the head
          R.......Enter RUN mode.
          D.......Enter Diagnostics mode.

          E.......Exit program.

(F)ile,(H)ome,(G)age,(R)un,(D)iag,(E)xit:(f)>
```

Fig. 1

```
            **************RUN MODE SUBMENU*************

   **** Press [ F1 ] key to Pause while in Motion.


           SEQ#    CMD          X          Y       THETA    SEC#
    NEXT      1      5      0.000      2.647       0.000       1

    POINTS:      Done       Total      %Done       Wire-File-Name
                    0        2246       0.00       rdc1c.dat


   Position: X=  0.001 Y=  2.646 T=  0.000
   Feed out wire.
   Press Carriage Return when finished and the head will be lowered>
   Press Carriage Return when ready to tack >
   Start Run (Y or N) >
```

Fig. 2

```
            **************RUN MODE SUBMENU*************

  **** Press [ Carriage Return ] to pause after next Inflection Point.
  **** Press [ F1 ] key to Pause while in Motion.


           SEQ#    CMD          X          Y       THETA    SEC#
    NEXT      5      0      0.570      3.703      45.000       1

    POINTS:      Done       Total      %Done       Wire-File-Name
                    2        2246       0.09       rdc1c.dat


   Position: X=  0.446 Y=  3.578 T= 72.000

   ***** Pause Event While in Motion*****
   Press [ F2 ] key to Continue From Point of Pause.
   Press [ F3 ] key to Raise the Head.
   Press [ F4 ] key to Lower the Head.
   Press [ F5 ] key to Return to Main Menu.
```

Fig. 3

(Attachment 4 cont'd)

```
          **************MANUAL HEAD CONTROL SUBMENU**************
          G.......Goto X, Y, Theta position.
          D.......Down Head toggle.
          S.......Short Lift toggle.
          F.......Feed Motor toggle.
          U.......Ultra/Sonics toggle.
          H.......High Pressure toggle.
          L.......Low Pressure toggle.
          O.......Change X/Y offsets.
          J.......Joy Stick Control.

          E.......Exit to Main menu

Down head.......O             Present Position
Short lift......O             x=   0.000
Feed motor......O             y=  -0.000
Ultra/sonics....O             t=   0.900
High Pressure...O
Low Pressure....O

G, D, S, F, U, H, L, O, J, E: (G)>
```

Fig. 4

```
          **************JOY STICK MODE SUBMENU**************

          B.......Assign JoyStick to (B)oth X & Y Velocities.
          T.......Assign JoyStick to (T)heta Velocity.
          O.......Toggle X & Y (O)ptical Limit Stop.

          E.......(E)xit to Diagnostic Menu.

B, T, O, E: ()>
```

Fig. 5

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Attachment 5 - Interlock Test Form

Instructions:

1. Post this form near the Machine.
2. Do not operate the Machine if the test has not been performed within the last six months.
3. Refer to RHIC-OPM 8.1.1.18, "Operation of Corrector Coil Wiring Machine", for the proper test procedure.
4. Check box as each device is tested; initial and date the form. If a failure occurs, write "fail" in the appropriate box, and immediately notify the CE and the ES&H Coordinator.

Interlock Test Form

CRASH SW. #1							
CRASH SW. #2							
CRASH SW. #3							
CRASH SW. #4							
OPT LIMIT SW. #1							
MECH LIMIT SW. #1							
OPT LIMIT SW. #2							
MECH LIMIT SW. #2							
OPT LIMIT SW. #3							
MECH LIMIT SW. #3							
OPT LIMIT SW. #4							
MECH LIMIT SW. #4							
INITIALS							
DATE